透水性反應牆之生物分解能力與菌群分佈研究

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摘 要

本研究主要利用實驗室級之釋氧反應牆系統，模擬受BTEX 污 染地下水之生物復育，並利用PCR-SSCP 之分子生物技術，監測系 統中微生物之菌群結構變化，及以生物刺激(biostimulation)(添加氧 氣釋放物質與氮源)及生物強化(bioaugmentation)(添加BTEX 之分 解菌株)等方法，探討微生物分解污染物之能力、菌群分佈及總生 菌數三者之消長關係。 釋氧物質(ORC)之管柱試驗結果顯示，於固定進流速度230 cm/day 下，釋氧率隨CaO_2 添加量之增加而提升(5 %~30 %)，但當 CaO_2 達30 %～60 %時之釋氧率皆約為0.22 mg O_2/day/g-ORC，顯 示CaO_2 添加至一定比例時，與釋氧率已不再成線性之正比關係 。 且ORC填充量(100 g 與300 g)與管柱進流流速(3.45、20、40 mL/min) 對ORC 之釋氧率並無顯著影響，而本研究自製之ORC 至少可連續 長期穩定釋放氧氣約達35 天之久。由釋氧反應牆分解BTEX 試驗 結果顯示：(1)在BTEX 進流濃度30 mg/L 下，有添加氮源與未添加 者，系統對BTEX 之處理能力依序為ethylbenzene＞p-xylene＞ toluene＞benzene；(2)在含氮源之生物刺激下，釋氧反應牆對BTEX 之去除效率高於未含氮源者，且生物強化作用對於系統之去除效率 有提升作用；(3)含氮源與未含氮源組在生物強化作用後之穩定期， 對BTEX 之去除效率分別為52.4 %與38.9 % (benzene)、72.3 %與 51.6 % (toluene)、80.2 %與71.4 % (ethylbenzene)及72 %與71 % (p-xylene)；(4)溶氧供給量與釋氧牆之距離成反比關係，因此距離 釋氧牆下游15 cm 處所監測到之總生菌數約高於30 cm 處之100 倍，由此研判距離釋氧牆下游5~30 cm 之間係為系統主要進行好氧 分解BTEX 之處；(5)含氮源與未含氮源組之整體生物相變化趨勢 類似，但BTEX 之去除效率及總生菌數之增加，可推測添加之氮源 對微生物之活性具提升作用；(6)綜合BTEX 之去除率、COD、溶 氧、總生菌數及菌群結構之結果，有助於評估釋氧反應牆進行受 BTEX 污染之地下水系統生物復育可行性。

關鍵詞 : 生物復育；生物刺激；生物強化；釋氧反應牆；釋氧物質；菌群結構

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